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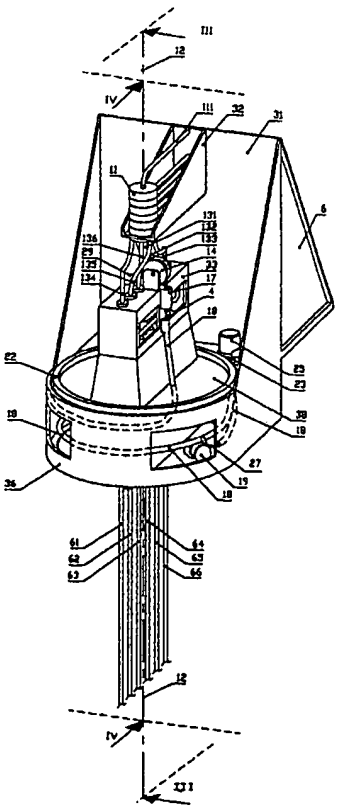
(54) Title: A CONNECTOR ASSEMBLY AND A CONNECTOR BODY FOR OFFSHORE TRANSFER OF FLUID



(57) Abstract: The invention relates to a connector assembly in a vessel (2), for offshore transfer of fluid between the vessel (2) and a connector body (3) which is connected to one or more risers (61-66) extending from the sea. The connector assembly comprises a rotatable connector housing (5) for receiving the connector body (3), and QC/DC (quick connection/disconnection) couplings (81-86) rotationally fixed relative to the connector housing (5). The connector assembly also comprises a fluid swivel (11) having rotatable parts (91-96) connected to intermediate pipes (121-126, 131-136) extending from the QC/DC couplings (81-86), and stationary parts (101-106) connected to piping (111-116) on the vessel (2).The invention also relates to a connector body (3) for offshore transfer of fluid between risers (61-66) and the connector assembly, the connector body has QC/DC couplings (71-76) for connection to the corresponding QC/DC coupling (81-86) of the connector assembly.

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A connector assembly and a connector body for offshore transfer of fluid

The invention relates to a connector assembly in a vessel, for offshore transfer of fluid between the vessel and a connector body which is connected to one or more risers extending from a loading station, the connector body can be pulled up to the connector assembly by a rope extending from the connector body, the connector body can be connected to the vessel by QC/DC (quick connection/disconnection) couplings, and the one or more risers are rotatable relative to the vessel by means of a fluid swivel.

The invention also relates to a connector body for offshore transfer of fluid between risers and a connector assembly.

When producing hydrocarbons from a subsea reservoir, the hydrocarbons can be transferred to a vessel for processing, storage or transport ashore. This loading can be done from a loading station, e.g. a floating storage buoy, a fixed or floating storage tank, or production equipment located on the sea floor. The vessel may be a tanker, but it can also be another structure, e.g. a floating platform structure. Normally the upper ends of one or more risers for the transfer of the hydrocarbons are secured to a connector body, which may have buoyancy chambers, and prior to the loading of the hydrocarbons this connector body is hoisted up to the vessel, and the risers are connected to piping on the vessel. The vessel may also be used for fluid injection in the reservoir, in order to maintain the reservoir pressure or deposit undesirable fluids, e.g. carbon dioxide. Further control fluids, e.g. pressurised hydraulic oil, may be transferred from the vessel to the loading station, in order to control e.g. valves on the sea floor. Thus there may be a transfer of fluids both to and from the vessel.

The vessel can during the loading be kept essentially stationary by anchoring or dynamic positioning. In order to allow rotation of the vessel, the connection between the vessel and the riser normally includes a fluid swivel. The risers are normally connected to the vessel by so-called QC/DC couplings, i.e. quick connection/disconnection couplings, which allow a quick disconnection of the risers if the weather gets too bad and relative movements between the riser and the vessel gets too big.

WO 93/11033 describes a buoy for use in loading or unloading of a flowable medium, especially oil, the buoy at its lower end being arranged for connection to at least one transfer line and further being arranged to be introduced into a submerged downwardly open receiving space in a floating vessel. In operation the buoy forms a transfer connection between the transfer line and a tube system on the vessel. The buoy comprises an outer buoyancy member arranged for receivable locking to the receiving space of the vessel by means of a locking mechanism

arranged therein, and centrally in the outer member a rotatable mounted member which forms a passage for medium and at its end is arranged for connection to the transfer line and the tube system on the vessel. The buoy at its upper end is connected to a means for hoisting and introducing the buoy into the receiving space of the vessel.

WO 93/11033 thus describes a buoy which can be connected to a vessel, and which has a swivel arrangement to enable rotation of the vessel. Such a buoy does, however, have the problem that relative motion between the vessel and the risers in the sea causes the swivel to be exposed to forces and bending moments from the risers, which in turn causes wear, possible malfunctioning of the swivel and a need to release the buoy from the vessel.

WO 95/ 01904 describes a similar buoy, the difference from WO/93/11033 being that the swivel is a multiswivel, for transfer of several fluids in separate channels. A rotating part of the multiswivel is permanently connected to the risers, and a stationary part of the multiswivel is permanently connected to the vessel. This is thus a more advanced swivel than in WO 93/11033, but the same problem exists: the multiswivel is exposed to forces and bending moments due to relative motion between the vessel and the risers.

Risers are from time to time pigged, i.e. a pig, which is a device with a diameter which is slightly smaller than the internal diameter of the riser, is sent through the riser for cleaning or other purposes. Therefore, the connector assembly and the connector body preferably should allow pigging.

The object of the invention is to provide a connector assembly in a vessel, for offshore transfer of fluid between the vessel and a connector body which is connected to one or more risers extending from a loading station, in which connector assembly the risers are rotatable relative to the vessel by means of a fluid swivel, which fluid swivel shall be protected from forces and bending moments from the risers. A further object is that the connector assembly shall allow pigging of the risers. A further object is to provide a connector body for offshore transfer of fluid between risers and the connector assembly. Preferably couplings of the connector body shall be protected from forces and bending moments from the risers.

According to the invention the objects are achieved by a connector assembly according to claim 1, and a connector body according to claim 12, respectively.

The invention thus relates to a connector assembly in a vessel, for offshore transfer of fluid between the vessel and a connector body which is connected to one or more risers extending from a loading station. The loading station may be a floating

buoy or subsea buoy or a subsea manifold which is connected to a piping system on the sea floor, or another fixed or floating structure, e.g. a loading arm of a storage buoy. Each risers may include one fluid pipe only, or each riser may have a number of separate pipes. When not in use in the transfer of fluids to the vessel, the connector body is located in a storage position at a distance below the sea surface. Prior to use, the connector body is pulled up to the connector assembly of the vessel by a hawser or rope extending from the connector body. Preferably the rope is a floating rope, and is so long that the end of the rope floats in the sea surface when the connector body is in the storage position, which makes it easy to pick up the rope.

The connector assembly comprises a rotatable connector housing for receiving the connector body, and QC/DC couplings which are rotationally fixed relative to the connector housing. Further the connector housing has guides for mating with corresponding guides of the connector body, for guiding the connector body into a coupling position in which QC/DC couplings of the connector body correspond with the QC/DC couplings of the connector assembly.

Preferably the connector housing is provided with a locking system, for locking the connector body in the coupling position when received by the connector housing. Preferably the locking system is adapted to be a single point suspension for the connector body and the risers.

The connector assembly also comprises a fluid swivel having rotatable parts connected to intermediate pipes extending from the QC/DC couplings, and stationary parts connected to piping on the vessel. The fluid swivel and the connector housing have a common rotational axis. The intermediate pipes transfer rotational motion between the rotatable parts of the fluid swivel and the QC/DC couplings, which means that the connector housing, the intermediate pipes and the rotatable parts of the fluid swivel rotate together. If the fluid transfer includes several fluids, this swivel is normally a multiswivel, which is a well-known piece of equipment to a person skilled in the art.

Since the fluid swivel is a part of the connector assembly, and is connected to the QC/DC couplings of the connector body via the intermediate pipes, there is no direct connection between the fluid swivel and the risers, and thus the fluid swivel is protected from forces and bending moments from the risers.

Preferably the QC/DC couplings of the connector assembly are suspended by the intermediate pipes, and preferably the intermediate pipes are arranged in arcs or loops, to provide flexibility to the connections between the OC/DC couplings of the connector assembly and the QC/DC couplings of the connector body, and also to the intermediate pipes.

Preferably the intermediate pipes have intermediate, releasable connections between the QC/DC couplings and the fluid swivel. When these connections are open, the fluid swivel and upper parts of the intermediate pipes can be rotated relative to the connector housing and lower parts of the intermediate pipes. This makes the lower parts of the intermediate pipes accessible through the intermediate connections. A pig launcher can then be brought into the area above the lower parts of the intermediate pipes, and connected to one of the intermediate connections, and a pig can then be launched through the corresponding intermediate pipe.

The invention also relates to a connector body for offshore transfer of fluid between risers and the connector assembly. For each riser, the connector body has a QC/DC coupling for connection to the corresponding QC/DC coupling of the connector assembly.

Preferably the QC/DC couplings of the connector body and the connections between the connector body and the risers are located on opposite sides of the connector body. Then forces and bending moments from the risers are transferred to the connector body and further on to the vessel, which means that the QC/DC couplings are protected from forces and bending moments from the risers.

Further objects, preferred embodiments and advantages of the invention will appear from the detail part of the description.

The invention will now be explained in more detail in connection with a description of a specific embodiment, and with reference to the drawings, in which:

fig. 1 is a perspective view of a ship which is loading hydrocarbons from a loading station via an arm with a connector assembly and a connector body according to the invention,

fig. 2 is a perspective view of the arm with the connector assembly in fig. 1 in closer detail,

fig. 3 is a sectional view as defined by arrows III-III in fig. 2, and

fig. 4 is a sectional view as defined by arrows IV-IV in fig. 2.

Fig. 1 illustrates a vessel in the form of a ship 2 which is lying in the sea 21, and which is loading hydrocarbons in the form of oil from a stationary loading station 1. The loading station 1 is a subsea manifold which is connected to a piping system 15 on the sea floor, which in turn is connected to not illustrated oil producing wells in a hydrocarbon reservoir.

Six flexible rises 61-66 hang in separate arcs from the subsea manifold 1 to a horizontal, cylindrical subsea buoy 16 which is anchored to the sea floor by a

mooring cable 9 which is connected to an anchor 43. From the buoy 16 the risers 61-66 hang in arcs to a connector body 3 according to the invention. Close to the connector body 3, the risers 61-66 are connected to mooring cables 40 which are anchored to the sea floor by anchors 42, and which is kept in tension by weights 41. The connector body 3 is received by a connector housing, which in turn is supported by a connector housing support 36. The connector housing, a fluid swivel 11 and intermediate pipes form the main items of the connector assembly according to the invention. These items will all be discussed in more detail later. The connector assembly is located at the end of an outwardly projecting arm 6 of the ship 2.

The ship is kept essentially stationary by dynamic positioning, which means that a control system controls propellers which bring the vessel towards the desired position. When loading to a dynamically positioned ship, preferably the ship should be allowed to weathervane, and the combination of the connector body and the connector assembly therefore should allow rotation of the ship.

If the weather gets too bad, the connector body 3 with the risers 61-66 have to be disconnected from the ship 2, in order not to damage the risers, the connector body or the connector assembly. Assisted by the tension in the cables 40 due to the weights 41, the connector body 3 with the risers 61-66 will then fall down into the sea 21, and sink to a storage position at a distance below the sea surface, where it will be suspended from the subsea buoy 16. The connector body 3 is provided with a floatable rope (not illustrated in fig. 1), which will seek to the sea surface. The connector body 3 may be designed as a buoy, which causes also the connector body to seek to the sea surface.

Prior to use, or prior to a reconnection after a storm, the floating rope is picked up, and the connector body is hoisted up to the connector assembly by the rope. The floating rope is a preferred embodiment. Generally the connector body 3 could be retrieved in other ways, e.g. the rope could be non-floatable and be provided with a float in the end, or the connector body could itself be floatable.

The risers 62-66 are hydrocarbon risers, which transfer hydrocarbons from the piping system 15 on the sea floor to the ship 2. Riser 61 is a control umbilical, i.e. a riser or hose with several internal pipes. The pipes in riser 61 transport control fluids, i.e. hydraulic oil, from the ship 2 down to the loading station 1, for controlling valves.

From the arm 6 the hydrocarbons are transported through piping 111-116 to a receiving plant 7 comprising process equipment and storage tanks in the ship 2. Thus, the loading takes place simultaneously with the production, but it should be understood that the invention is independent upon the number of risers and their

service. Examples of other type of service are loading oil from a storage tank or injecting water in the hydrocarbon reservoir. Further the invention is independent of the location of the connector assembly, which e.g. could have been located at an arm in the bow of the ship, or above a moonpool in the bottom of the ship.

Fig. 2 is a perspective view of the arm with the connector assembly in fig. 1 in closer detail. The arm 6 has a support bracket 31 for the connector housing support 36, and a swivel bracket 32 for the fluid swivel 11. A pipe housing 33 covers intermediate pipes and QC/DC couplings, which will be discussed later.

Arrows III-III and IV-IV define sectional views which are illustrated in fig. 3 and 4, respectively. Since fig. 2, 3 and 4 illustrate the same items from different views, the invention will in the following be discussed without reference to any particular figure.

Reference numerals 61-196 are used for items related to the through-put of the fluid flows, and the last digits identify the fluid flow, i.e. reference numeral 61, 71, 81 etc. relate to the same fluid flow.

The hydrocarbon risers 62-66 are connected to the connector body 3 by flanges 192-196 located below the connector body 3. The risers 62-66 are fairly flexible, made from steel reinforced rubber, while the pipes leading from the flanges 192-196 are fairly stiff steel pipes. Riser 61, which is a smaller control umbilical, has no flange connection below the connector body 3. The connector body 3 is provided with a central post 34 with an eye 35. A rope 4 is attached to the eye 35, for hoisting the connector body 3 up to the connector assembly. It is seen from fig. 3 that the pipe housing 33 has a central opening 13, and that the central post 34 has been pulled through the central opening 13 and project above the pipe housing 33.

The connector assembly comprises a rotatable connector housing 5 for receiving the connector body 3. The connector housing 5 is provided with an upper flange 38 and a lower flange 37, which by means of not illustrated bearings are rotationally supported by the housing support 36. The connector housing 5 can thereby be rotated around a rotational axis 12, which in the illustrated embodiment is vertical.

Further the connector assembly comprises QC/DC couplings 81-86 which are rotationally fixed relative to the connector housing 5. The connector body 3 also has QC/DC couplings 71-76, one for each riser, for connection to the corresponding QC/DC coupling 81-86 of the connector assembly. The QC/DC couplings, i.e. "quick connection/disconnection" couplings, are standard couplings which are well known to a person skilled in the art. Several types of QC/DC couplings are available, and will typically be of the male-female type. Thus, the QC/DC couplings are schematically illustrated.

Each QC/DC coupling is provided with an isolation valve, i.e. the QC/DC couplings 71-76 of the connector body 3 each have an isolation valve 171-176, and the QC/DC couplings 81-86 of the connector assembly each have an isolation valve 181-186. These isolation valves, which are standard equipment, automatically close before the QC/DC couplings are disconnected, and open after the QC/DC couplings are connected.

The connector housing 5 has guides 8, and the connector body 3 has guides 10, which can mate with each other when the connector body 3 is hoisted up to the connector assembly and enters the connector housing 5. In the illustrated embodiment the guides 8, 10 are formed by essentially rectangular, upwards tapering surfaces of the connector housing and connector body, respectively. The guides 8, 10 guide the connector body 3 into a coupling position in which the QC/DC couplings 71-76 of the connector body 3 correspond with the QC/DC couplings 81-86 of the connector assembly, as illustrated in fig. 3. Then the QC/DC couplings mate and allow the fluid to flow.

Preferably the connector housing 5 is provided with a locking system for locking the connector body 3 in the coupling position when received by the connector housing 5. This will be discussed in more detail later.

The connector assembly further comprises a multi fluid swivel 11, with stationary parts 101-106 and rotatable parts 91-96, which define annular, concentric fluid spaces and provide inlets and outlets to these fluid spaces. The fluid swivel 11 thereby allows transfer of fluids between the stationary parts and the rotatable parts. The stationary parts 101-106 are connected to the piping 111-116 on the vessel 2, and the rotatable parts 91-96 are connected to intermediate pipes, extending from the QC/DC couplings 81-86. In this embodiment the intermediate pipes consist of lower intermediate pipes 121-126 and upper intermediate pipes 131-136, which will be discussed later. It is seen that the QC/DC couplings 81-86 actually are suspended from the lower intermediate pipes 121-126.

Like the connector housing 5, the fluid swivel 11 rotates around the rotational axis 12. The rotation of the fluid swivel is provided by not illustrated bearing arrangements.

The lower intermediate pipes 121-126 are routed through openings 161-166 in the pipe housing 33. The openings 161-166 thereby prevent lateral movement of the intermediate pipes relative to the pipe housing 33, i.e. the intermediate pipes are rotationally fixed relative to the pipe housing 33. The pipe housing 33 is an extension of and forms a part of the connector housing 5, and since the intermediate pipes are connected to the QC/DC couplings 81-86 of the connector assembly, the QC/DC couplings 81-86 are rotationally fixed relative to the

connector housing 5. Further this means that the intermediate pipes 121-126, 131-136 transfer rotation between the connector housing 5 and the fluid swivel 11.

In order not to harm the risers, the connector body 3 should not be rotated. Due to the fluid swivel 11 and the rotatable connector housing 5, a rotation of the ship 2, which may be required due to change of wind direction, can take place without any rotation of the connector body and the risers. The risers will to some extent prevent the connector body 3 from rotating, but to ensure that the connector housing 5 and the connector body 3 is kept stationary, i.e. rotate relative to the ship when the ship rotates, the rotation of the connector housing 5 is preferably controlled. A controlled rotation is also advantageous in order to rotate the connector housing 5 into alignment with the connector body 3 when the latter is hoisted up to and into the connector housing 5.

In the illustrated embodiment, see fig. 2, the controlled rotation of the connector housing 5 is achieved by a gear rim 22 arranged along the circumference of the upper flange 38 of the connector housing 5, a pinion 23 which meshes with and rotates the gear rim 22, and which is driven by a hydraulically driven motor 25 which is controlled by a control system which receives input from the control system for the dynamic positioning of the ship.

The openings 161-166 in the pipe housing 33 do not prevent movement of the intermediate pipes or the QC/DC couplings 81-86 in the axial direction of the connector assembly. Thus there is some flexibility between the QC/DC couplings and the fluid swivel 11. The fact that there is no direct connection between the fluid swivel 11 and the risers 61-61, together with the flexibility of the intermediate pipes, make the fluid swivel 11 protected from forces and bending moments from the risers.

Preferably the intermediate pipes 121-126, 131-136 are arranged in arcs or loops, as illustrated, to provide further flexibility to the intermediate pipes, which further protects the fluid swivel 11 from forces and bending moments from the risers.

Preferably, as illustrated, the QC/DC couplings 71-76 of the connector body 3 and the connections 192-196 for the risers 62-66 are located on opposite sides of the connector body 3, since forces and bending moments from the risers are then transferred to the connector body 3 and not to the QC/DC couplings. From the connector body 3 the forces and bending moments from the risers are transferred to the housing support 36 through the bearings (not illustrated), and further on to the vessel. Thus the QC/DC couplings 71-76 of the connector body 3 and the QC/DC couplings 81-86 of the connector assembly are protected from forces and bending moments from the risers.

It is seen from fig. 3 that the intermediate pipes have intermediate, releasable connections, formed by lower flanges 141-146 and upper flanges 151-156, located between the QC/DC couplings and the fluid swivel. When these flange connections are open, the fluid swivel 11 and the upper intermediate pipes 131-136 can be rotated relative to the connector housing 5 and the lower intermediate pipes 121-126. This rotation can be done by a not illustrated motor, or it can be done manually. The lower intermediate pipes are thereby accessible, and a pig launcher (not illustrated), which can be suspended from an overhead travelling crane, can be connected to one of the lower flanges 141-146. A pig can then be launched from the pig launcher. This allows internal cleaning or wax removal of the hydrocarbon risers, and is very favourable. Obviously such a pigging involves the operation of a number of valves, which are not illustrated.

As discussed, the pipe housing 33, which is an extension of the connector housing 5, has a central through going opening 13 for the rope 4 which is attached to the eye 35 in the central post 34 which forms a part of the connector body 3. A capstan winch 14 for the rope 4 is located above the opening 13, on top of the pipe housing 33, for hoisting the connector body 3 with the risers up to the connector housing 5.

As discussed, the rope 4 which is attached to the connector body 3 preferably is a floatable rope, which means that it is easy to pick the rope up from the sea. Then there is no need for a float in the end of the rope, and the rope can therefore be pulled directly through the central opening 13 in the pipe housing 33, and around the capstan winch 14.

The connector housing 5 is provided with a rope tensioner 17, for tensioning the rope 4. The rope tensioner 17 is provided with hydraulically actuated tensioning rollers 39, which maintain a constant tension in the rope 4. When picking up the rope 4 from the sea 21, the rope 4 is pulled through the central opening 13 in the pipe housing 33, arranged one or more turns around the capstan winch 14, and through the rope tensioner 17.

Preferably, as illustrated, the connector housing 5 is provided with a guide pipe 18 for the rope 4, arranged along the circumference of the connector housing 5. The guide pipe 18 is arranged in a helix around the connector housing 5, and provides a convenient storage for the rope 4 when the connector body 3 is in the coupling position.

In a further preferred embodiment, the connector housing 5 is also provided with a winch 19 for a pick up wire, see fig. 2. The pick-up wire is not illustrated. The winch 19 is located near the end of the guide pipe 18 which is opposite the rope tensioner 17. It is also illustrated an end 27 of the rope 4, located in the end of the guide pipe 18. Prior to hoisting the rope 4 and the connector body 3 up from the

sea 21, the pick-up wire is lowered into the sea and attached to the end 27 of the rope 4. The rope 4 is then pulled through the central opening 13 in the connector housing 5, arranged one or more turns around the capstan winch 14, and further pulled through the rope tensioner 17 and the guide pipe 18, into the storage position which is illustrated in fig. 2.

As discussed, in the illustrated embodiment the connector housing 5 is provided with a locking system for locking the connector body 3 in the coupling position when received by the connector housing 5. In the illustrated embodiment this locking system is located on top of the pipe housing 33, and comprises a lock bolt 28 which by means of a remote controlled hydraulically operated locking cylinder 29 can be inserted into and withdrawn from a locking indent 30 in the central post 34.

Preferably, in order to enable the use of standard QC/DC couplings, no external loads should be applied to the QC/DC couplings. This can be achieved by adapting the locking system to support all the weight of the connector body 3 and the risers 61-66, which can be achieved by correct dimensioning of the various components of the locking system, particularly the lock bolt 28, and the components which support the locking system, particularly the pipe housing 33.

When dimensioned to take all the weight of the connector body 3 and the risers 61-66, the locking system forms a single point suspension for the connector body and the risers. This single point suspension allows a very quick release of the connector body 3 in an emergency situation, and is thus very favourable. This release can be carried out by withdrawing the lock bolt 28 from the locking indent 30 in the central post 34 by means of the hydraulically operated cylinder 29, which will cause the connector body 3 to simply fall down into the sea. During this release of the connector body, preferably the rope 4 is kept tensioned by the capstan winch 14, and the capstan winch is preferably provided with a brake or control means for controlling the speed of the capstan winch and consequently the speed of the rope and the connector body during the release. This can be achieved by a hydraulically driven capstan winch, and a choke which limits the flow of hydraulic fluid during the release of the connector body. In this way it can be ensured that the speed of the connector body is kept at a safe level, in order to avoid damage to the connector body and the risers when they hit the sea surface.

CLAIMS

1. A connector assembly in a vessel (2), for offshore transfer of fluid between the vessel (2) and a connector body (3) which is connected to one or more risers (61-66) extending from a loading station (1), the connector body (3) can be pulled up to the connector assembly by a rope (4) extending from the connector body (3), the connector body can be connected to the vessel by QC/DC (quick connection/disconnection) couplings, and the one or more risers (61-66) are rotatable relative to the vessel by means of a fluid swivel, the connector assembly is characterised by comprising:

a rotatable connector housing (5) for receiving the connector body (3), and QC/DC couplings (81-86) which are rotationally fixed relative to the connector housing (5), the connector housing (5) has guides (8) for mating with corresponding guides (10) of the connector body (3), for guiding the connector body (3) into a coupling position in which QC/DC couplings (71-76) of the connector body (3) correspond with the QC/DC couplings (81-86) of the connector assembly,

a fluid swivel (11) having rotatable parts (91-96) connected to intermediate pipes (121-126, 131-136) extending from the QC/DC couplings (81-86), and stationary parts (101-106) connected to piping (111-116) on the vessel (2), the fluid swivel (11) and the connector housing (5) having a common rotational axis (12), and that the intermediate pipes (121-126, 131-136) have intermediate, releasable connections (141-146, 151-156) between the QC/DC couplings and the fluid swivel, to allow pigging.

2. A connector assembly according to claim 1, characterised by that the QC/DC couplings (81-86) of the connector assembly are suspended by the intermediate pipes (121-126, 131-136).

3. A connector assembly according to claim 1 or 2, characterised by that the intermediate pipes (121-126, 131-136) are arranged in arcs or loops, to provide flexibility.

4. A connector assembly according to any of the preceding claims, characterised by that the connector housing (5) is controlled rotatable (22, 23, 25).

5. A connector assembly according to any of the preceding claims, characterised by that the connector housing (5, 33) has a central through going opening (13) for the rope (4) from the connector body (3), and is provided with a capstan winch (14) for the rope (4) above the opening (13), for pulling the connector body (3) up to the connector housing (5).

6. A connector assembly according to claim 5, characterised by that the connector housing (5, 33) is provided with a rope tensioner (17), for tensioning the rope (4) from the connector body (3), the rope (4) being routed from the connector body (3), through the central opening (13) in the connector housing (5), one or more turns around the capstan winch (14), and through the rope tensioner (17).

7. A connector assembly according to any of the preceding claims, characterised by that the connector housing (5) is provided with a guide pipe (18) for the rope (4), arranged along the circumference of the connector housing (5), for storing the rope (4) when the connector body (3) is received by the connector housing (5).

8. A connector assembly according to claim 8 when dependent upon claim 6, characterised by that the connector housing (5, 33) is provided with a winch (19) for a pick up wire, located near the end of the guide pipe (18) opposite the rope tensioner (17), for pulling up the rope (4) and the connector body (3) from the sea (21) by attaching the pick up wire to the end (27) of the rope (4) when the rope (4) is in the sea (21), and pulling the rope (4) through the central opening (13) in the connector housing (5, 33), one or more turns around the capstan winch (14), through the rope tensioner (17), and through the guide pipe (18).

9. A connector assembly according to any of the preceding claims, characterised by that the connector housing (5, 33) is provided with a locking system (28-30), for locking the connector body (3) in the coupling position when received by the connector housing (5).

10. A connector assembly according to claim 9, characterised by that the locking system (28-30) is adapted to be a single point suspension for the connector body (3) and the risers (61-66).

11. A connector body (3) for offshore transfer of fluid between risers (61-66) and a connector assembly according to any of the preceding claims, characterised by, for each riser (61-66), the connector body has a QC/DC coupling (71-76) for connection to the corresponding QC/DC coupling (81-86) of the connector assembly.

12. A connector body (3) according to claim 11, characterised by that the QC/DC couplings (71-76) of the connector body (3) and connections (192-196) for the risers (62-66) are located on opposite sides of the connector body (3).

13. A connector body (3) according to claim 11 or 12, characterised by that the connector body (3) is provided with a floatable rope (4).

14. A connector body (3) according to any of the claims 11 to 13, characterised by that the connector body (3) has guides (10) for mating with the guides (8) of the connector housing.

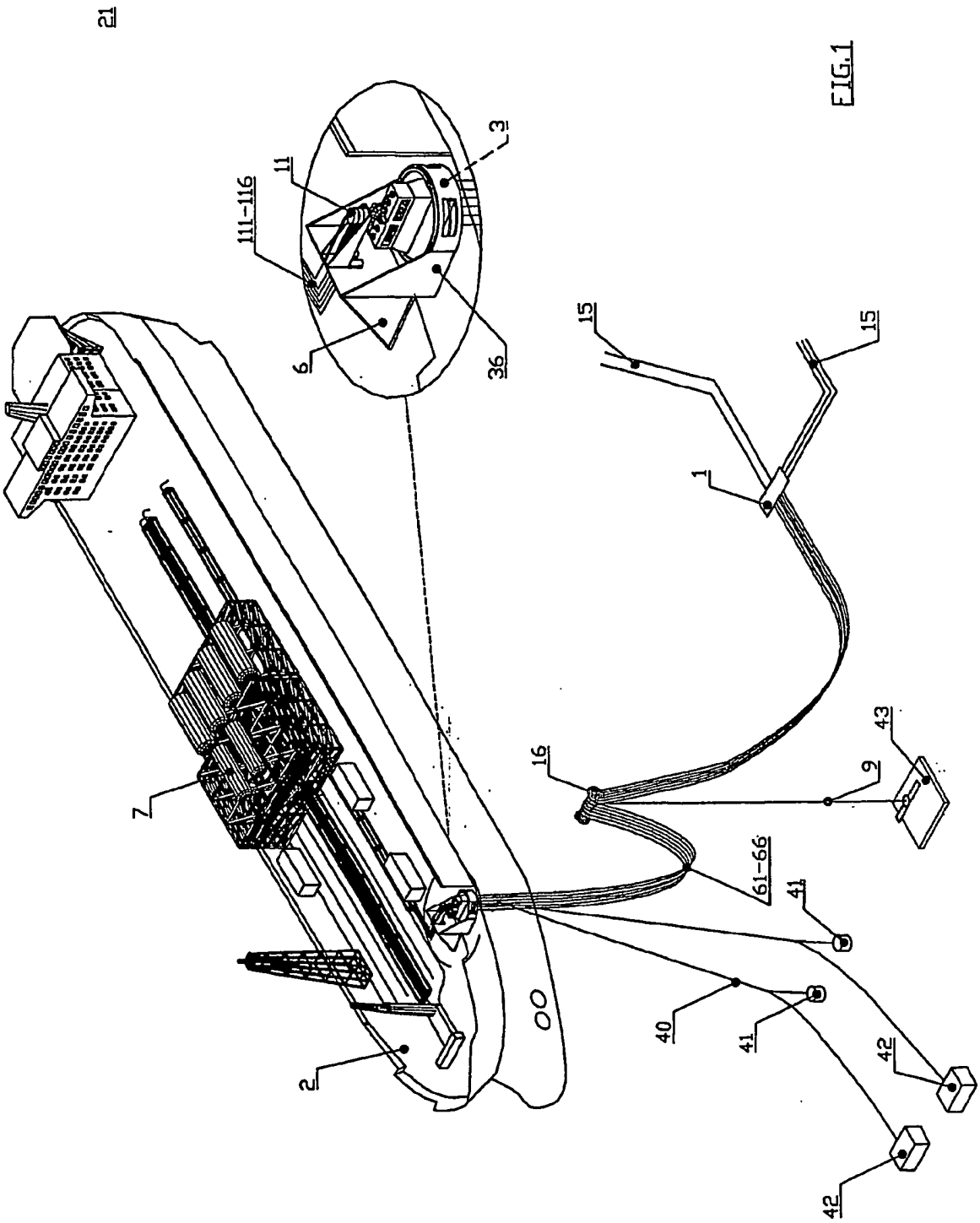

FIG.1

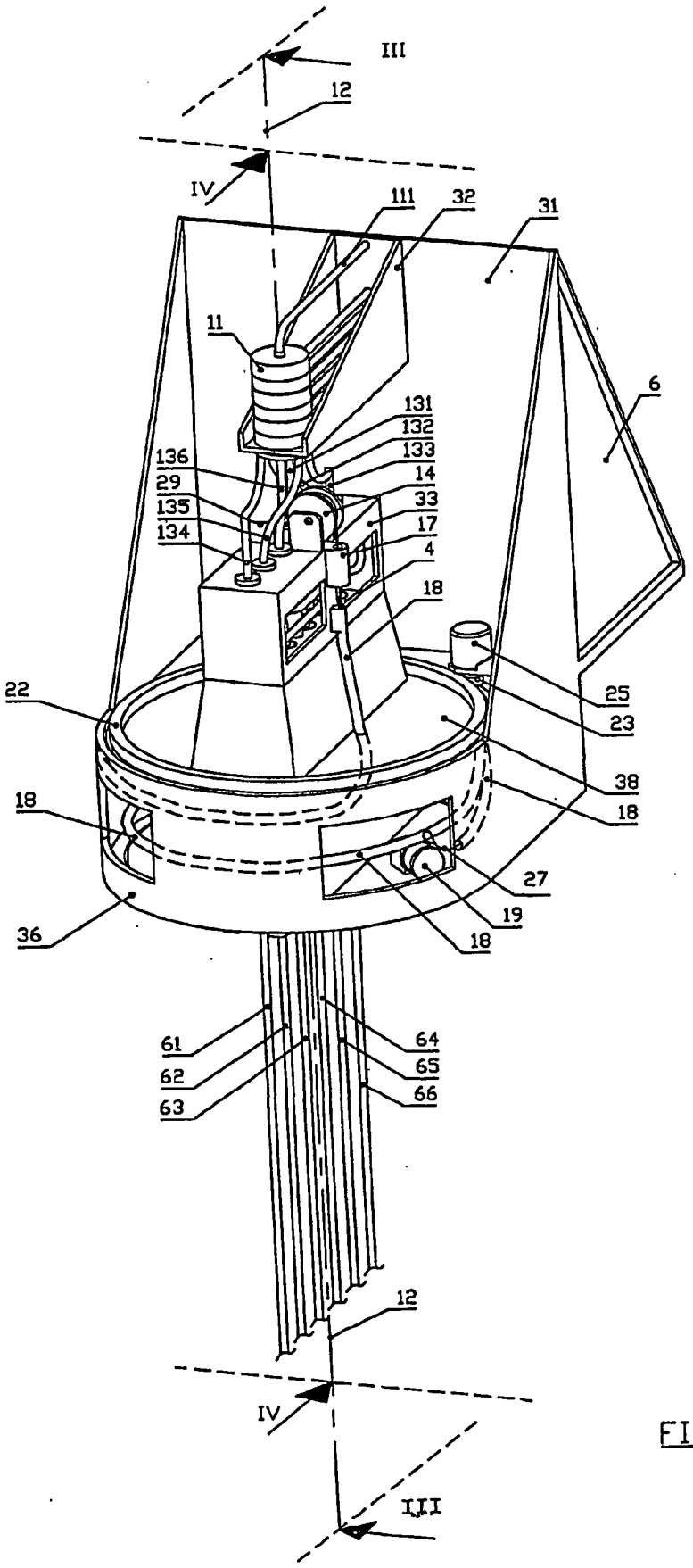
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FIG. 1

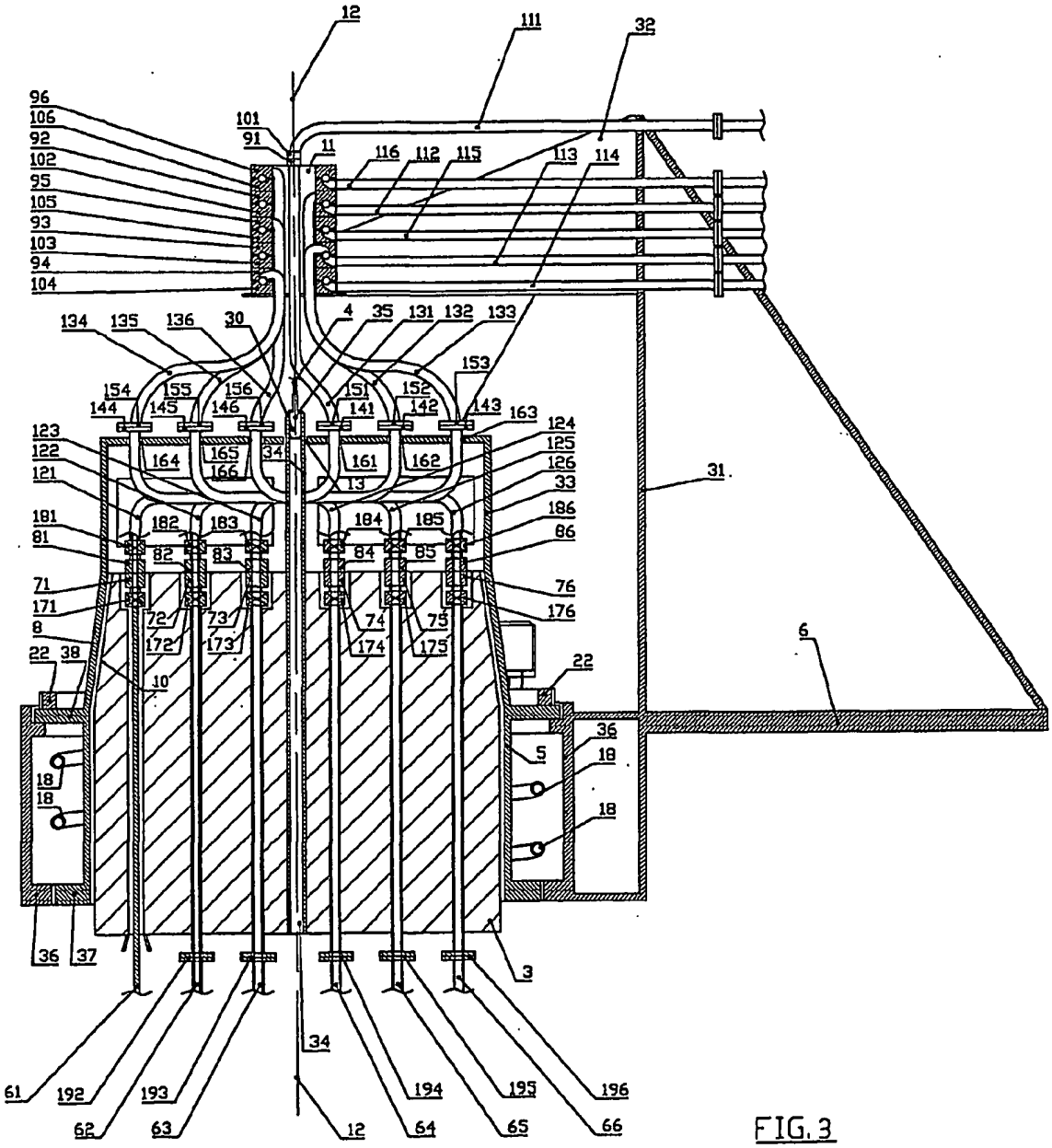
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FIG. 3

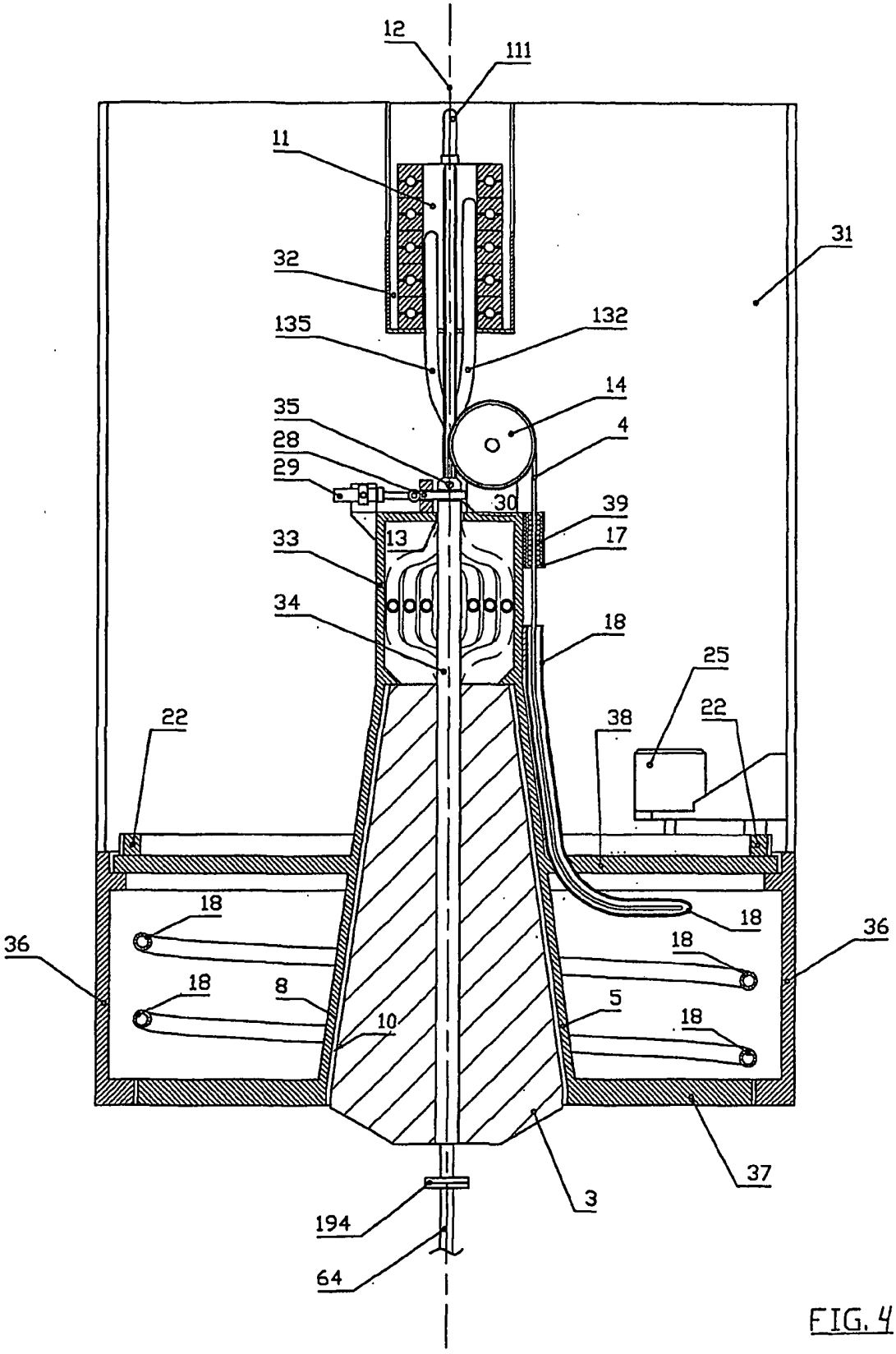
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FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO 02/00172

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B63B 27/30, B63B 22/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B63B, B67D, F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5823837 A (BOATMAN ET AL), 20 October 1998 (20.10.98), column 5, line 35 - column 6, line 7	1,4,5,9,11
Y	--	2
Y	WO 9324733 A1 (DEN NORSKE STATS OLJESELSKAP A.S), 9 December 1993 (09.12.93), page 7, line 19 - line 28	2
	--	

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 Sept 2002	17 09. 2002
Name and mailing address of the International Searching Authority European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Douglas Elliot /js Telephone No.

INTERNATIONAL SEARCH REPORT

Information on patent family members

06/07/02

International application No.
PCT/NO 02/00172

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5823837 A	20/10/98	NONE	
WO 9324733 A1	09/12/93	AU 677204 B	17/04/97
		AU 4359793 A	30/12/93
		DK 683846 T	13/11/00
		EP 0683846 A,B	29/11/95
		NO 176130 B,C	31/10/94
		NO 922044 A	26/11/93
		RU 2121055 C	27/10/98